Quark Matter 2009 : March 30th - April 4th, 2009 : Knoxville, Tennessee

Significant in-medium $\eta\prime$ mass modification in $\sqrt{s_{nn}} = 200$ GeV Au+Au collisions

R. Vértesi[a], **T. Csörgő**[a,b], **J. Sziklai**[a]

[a] MTA KFKI RMKI
H-1525 Budapest, P.O.Box 49, Hungary

[b] Dept. Physics, Harvard University
17 Oxford Street, Cambridge, MA 02138, USA

Contact e-mail: *vertesi@rmki.kfki.hu*

In high energy heavy ion collisions, a hot and dense medium is created, where the $U_A(1)$ or chiral symmetry may temporarily be restored [1-3]. As a consequence, the mass of the $\eta\prime$ mesons may significantly be reduced, and the abundancy of $\eta\prime$ mesons at low p_T may be enhanced by more than a factor of 10. The intercept parameter λ of the charged pion Bose Einstein Correlations provides a sensitive observable of the enhanced $\eta\prime$ abundancy [4]. PHENIX and STAR data on $\lambda(m_T)$ were analysed [5,6], using extensive Monte Carlo simulations based on six popular models for hadronic abundances. In-medium $\eta\prime$ mass $m^*_{\eta\prime}$ and the inverse slope parameter B^{-1} of the $\eta\prime$ spectra were varied in small steps to obtain a χ^2 map, while other freezeout and flow parameters were taken from PHENIX measurements.

The best simultaneous description of STAR and PHENIX data is achieved with an $\eta\prime$ mass that is dramatically reduced from 958 MeV to 330 MeV in the medium created in central Au+Au collisions at RHIC. Based on the combined STAR and PHENIX data, and from the systematic investigation of various resonance abundances and model parameters [7], **we conclude that the mass of $\eta\prime$ meson is reduced by more than 200 MeV in central Au+Au reactions, at the 99.9 % confidence level**. A similar analysis of NA44 S+Pb data at top CERN SPS energies provided no evidence of in-medium $\eta\prime$ mass modification.

Our results should revitalize theoretical interest in other signatures of partial $U_A(1)$ and chiral symmetry restoration in heavy ion reactions and also should be cross-checked against other observables like the enhancement of low-mass dileptions in the same reactions. Further, more detailed and more precise experimental data are needed on the intercept parameter of Bose-Einstein correlations of pions at low p_T at various bombarding energies, system sizes and centralities to establish the onset of partial $U_A(1)$ symmetry restoration.

References

[1] T. Kunihiro, Phys. Lett. **B219** 363 (1989); ibid. **B245** 687(E) (1990).
[2] J. Kapusta, D. Kharzeev and L. McLerran, Phys. Rev. **D53** 5028 (1996).
[3] Z. Huang and X.-N. Wang, Phys. Rev. **D53** 5034 (1996).
[4] S. Vance, T. Csörgő and D. Kharzeev, Phys. Rev. Lett. **81** 2205 (1998).
[5] S. Adler *et al.* [PHENIX Collaboration], Phys. Rev. Lett. **93** 152302 (2004).
[6] J. Adams *et al.* [STAR Collaboration] Phys. Rev. **C71** 044906 (2005).
[7] `http://www.rmki.kfki.hu/~vertesi/etap_bec`